INSTITUTION OF CIVIL ENGINEERS.

June 25.—The President in the Chair.

A paper was read descriptive of the removal of the lighthouse on the north pier of Sunderland Harbour, by Mr. J. Murray, M. Inst. C.E. The lighthouse, which was built in 1802, was 76 feet in height and 15 feet in diameter at its base, slightly tapering upwardly to the lantern, which was lighted with coal-gas with parabolic reflectors. It was built of polished stone and had within it a spiral staircase; its total weight was 338 tons, which being concentrated on an area of only 162 square feet, rendered the task of its removal in an entire mass a work of much difficulty and danger, especially when its great height was considered. Mr. Murray was induced to propose its removal, without taking it down, in consequence of the expense which would have been incurred in the establishment of a temporary light on the pier, the cost of building another lighthouse, and the success with which dwelling-houses had been removed entire in the United States. The decision was accelerated by a serious breach being made by the sea in the wall of the pier on which it stood, and in consequence, the work of removal was commenced on the 15th of June, 1841, by the masons cutting the holes for inserting the timbers for forming the cradle; those directly beneath the building were carried by 144 cast-iron rollers, travelling on 8 lines of iron rails, and the outer timbers, supporting the braces and struts, were placed upon slide-balks, which were lubricated with a mixture of soft soap and black-lead to diminish the friction. The power applied was by means of several drawing and pushing screws, and by three winches with ropes and tackle blocks, worked by eighteen men. On the 2nd August the mass was moved a distance of 28 feet 6 inches in a northerly direction, to place it in the line of the new pier. After changing the position of the rollers and slide-balks, to adapt them first to a curve of 647 feet radius, and then to a straight line in an easterly direction, the cradle with its load was propelled steadily forward at an average rate of 33½ feet per hour when in motion; the entire time of moving over 447 feet being 13 hours 24 minutes. Much time was of course occupied in taking up and relaying the rails and balks, and in preparing a solid foundation for them, as the mass advanced; so that it was not until the 4th of October that the lighthouse arrived at the extremity of the pier, where the foundation was prepared for it. The timbers were withdrawn gradually, the spaces being filled up with solid masonry, and the building was stated to have remained to the present time in a solid state without the slightest appearance of even a crack in the walls. A light was exhibited in the lantern as usual every night during its transit. The entire cost of executing the work was 827*l.*, and it was shewn that an actual saving of 893*l.* had been made by adopting the plan of removal instead of building a new lighthouse.

A paper by Professor Hosking, of King's College, containing some suggestions for the introduction of constructions to retain the sides of deep cuttings in clays and other uncertain soils, was then read. These constructions were chiefly intended to be introduced in situations where, on account of the bad nature of the soil, open cuttings or tunnels would be expensive and dangerous; they consisted of buttress walls placed at intervals along the length of the line and opposite to one another, strutted at their toes by an inverted arch, and above by built beams of brickwork at given heights, discharging arches being turned from buttress to buttress to carry the beams. The buttresses were to be made the springing walls of longitudional counter-arched retaining walls, and all the force exerted against them would be conveyed to the buttresses, and from thence to the arches and built beams. The author then gave a detailed estimate of the expense of forming an open clay cutting with slopes at 2½ to 1, and of the proposed constructions, the same data being taken in both cases, from which it appeared that the difference was nearly one-third in favour of the constructions.

It was stated by Captain Vetch that a similar kind of construction had been successfully used in the Mosely cutting on the line of the Birmingham and Gloucester Railway, and General Pasley stated that Mr. Adie had introduced that kind of construction on the Bolton and Preston Railway.

A paper by Mr. J. Bremner, M. Inst. C.E., described the mode adopted by him for rebuilding the piers of Sarclet Harbour (Caithness, N.B.), after they had been twice destroyed by the sea, to whose action it is much exposed, the waves frequently breaking over the works at a height of 50 feet. The works required to be completed with great rapidity, as the season in which they could be carried on was very limited. Mr. Bremner therefore contrived several gigantic cranes, which were fixed at about 20 feet above high water mark; the longest commanded a radius of 115 feet, and by it a cargo of 20 tons of large stones could be unloaded from a barge and conveyed a distance of 230 feet in half an hour, and it afforded similar facility for laying the blocks of stone in their places in the building, as also for depositing materials in front of a breach which had been made by the sea in the new work, which without such efficient means would have been, as before, entirely destroyed. The machinery and general mode of building adopted by Mr. Bremner were minutely described, and some remarks as to the inefficiency of vertical pier walls for resisting the force of the waves in exposed situations appeared to attract the attention of the members, and but for its being the last evening of the session, and the time being required for the ballot for members, an interesting discussion would probably have ensued.

The President addressed the meeting on the merits of a few of the papers which had been read during the session, and at the ballot Sir John Rennie, Messrs. D. Stevenson (Edinburgh), G. M. Miller, and R. B. Grantham, were elected members; and Messrs. Lieut. Riddell, R.A., E. Hooper, W. Vanderkiste, H. Hensman, and R. Dunkin, as associates.

SOMATOLOGY, OR THE ESSENTIAL AND CONTINGENT PROPERTIES OF MATTER.

BY ALEXANDER JAMIESON, LL.D.

(*Continued from p. 322.*)

Solidity is the consequence of the irregular figure of the particles, and their great deviation from sphericity, by which free motion among them is prevented, and their cohesion better secured. Now the diversity in solids arises from the various degrees of strength in the limits of cohesion; and the same principles will give rise to a class of bodies intermediate betwixt solids and fluids, namely, the viscous, whose particles attract each other more strongly than the fluids and not so strongly as the solids.* We here see how we may account for the following facts:—

Of the conversion of rock into clay, or a solid body into an elastic one, we have ample evidence upon the island of St. Helena, a volcanic production, situated in the unfathomable ocean, and not surrounded by shoals, as islands generally are. The rock of which this island is composed is of great variety, in some places resembling basalt in texture, colour, and general character; in other places it is extremely porous, vesicular, and cellular, indeed almost cavernous. Very often it has quite the appearance of a slag; while at other places a slaty structure is found, the imperfect strata appearing variously inclined. In its decomposition and conversion into clay, the rock shews much variety; for in the same mass some part is entirely decomposed and converted into clay, while another part is not in the least altered. The decay is greatest at the surface, where the rock is exposed to an atmosphere charged with more rain than the wettest parts of Devonshire; but this decay is not exclusively confined to the exposed parts. The clays which are formed from the decayed rock are of several colours, of which brick-red and pink-red are the most common: the latter produced perhaps by manganese. Owing to the facility with which most of these rocks decompose, the soil is generally deep. Even in the most barren spots in the neighbourhood of James's Town, there is no deficiency of soil.

The general fact ascertained in this detail of rock decomposing into clay is this: Solid bodies may be converted into those that are elastic, and by the mere action of the atmosphere are so changed; elastic bodies may be converted into solid ones, as we shall endeavour to prove by the following example:

A block of gypsum or alabaster, dug from the quarry, will preserve any figure a sculptor may choose to chisel it into; but put the figure he has carved, with much art, into a kiln or oven, and subject it to a red heat, its symmetry and beauty will now be destroyed, and the figure reduced to a fine powder; but this being mixed with water, may again be moudled into any figure we please. In this state it is called plaster of Paris.

The hot springs of St. Philip, which supply the baths of Tuscany, are so strongly impregnated with alabaster, that artists take advantage of this to obtain impressions of bas-reliefs, merely exposing their moulds to a current of the water until they become filled with the earthy deposit: these impressions, when taken out, are found to be as hard as marble, and as very beautiful. In the British Museum there are some casts of medals from the water of those springs.

You may satisfy yourself that water holds in solution mineral substances by the following simple experiment:—Fill a wine-glass half-full of prepared lime-water, and breathe into the fluid for a few minutes by means of a tobacco-pipe, reed, or glass tube. The lime-water will speedily become turbid, and a white precipitate will fall to the bottom of the glass. The reason of this is, that a carbonic acid gas is expired from the lungs, and combines with the lime in the water, forming a sub-carbonic of lime, which, not being soluble in water, is precipitated. The moulds on which the gems are formed at the springs of St. Philip may have perhaps some affinity for the gypsum held in solution by the water. To understand how water holds minerals in solution, we shall take leave in this place to give our readers some idea of the composition of water, considered either as hard or soft, for, by having a distinct idea of this chemical definition and of this fluid, and the tests by which to discriminate its qualities, we shall the more readily comprehend the subsequent reasonings in which water becomes a principal agent.

Water is composed of oxygen and hydrogen, but these gases do not permit any property to be perceived. These two gases are therefore combined at the point at which their reciprocal affinity exercises the greatest effect, and they are in that state which may be compared with that of a neutral salt, in which the acid and alkaline properties have equally become latent. In strict chemical language, water should be styled the oxide, or protoxide of hydrogen; but as the term by which it is known is much shorter, and more familiar, it is universally applied. The term water is of Saxon origin, but chemists call it the protoxide, to distinguish it from a second compound of the same elements, which is water impregnated with 662 parts of its bulk of oxygen. This is the deutoxide, or peroxide of hydrogen.

Water, then, being an oxide, possesses neither acid nor alkaline properties; and consequently, if it were always pure, there would be no room for the distinction of hard and soft. In nature, however, it is seldom or never found in a state of purity.

That which is least contaminated by the admixture of foreign substances, is rain or snow water. But even that is not entirely free; because it becomes deteriorated by the different vapours it encounters in its descent. Water obtained from this source as well as from rivers, and by boring the earth to a considerable depth, is called soft because it possesses qualities somewhat different from those of spring water, which is denominated hard.

Hard and soft water then differ in this respect: the former holds in solution metallic and earthy salts; the latter possesses none of these. Hence, hard water impregnated with these foreign compounds is unfit for washing, boiling esculent vegetables, dyeing, and many other purposes of domestic life. Carbonate of lime or chalk, and the sulphates of lime and magnesia, comprise also other contaminating substances found in hard water. Spring water is clear and of a grateful flavour by reason of the abundance of carbonic acid which it holds in solution.

Every one knows that chalybeate water holds certain mineral substances in solution

* Ency. Brit. IV., p. 58.

For more information on PDF Compression and OCR visit our website